it has attracted much attention. It is manifestly produced in the upper regions of the atmosphere; for it is best seen from elevated mountains, where it is continually visible in clear weather. It is often hidden at low stations by the plentiful reflected skylight that comes from the coarser dust of the lower atmosphere, even though the sky seem tolerably clear. It has been astonishingly distinct here in Cambridge through the past winter, on the clear anti-cyclonic days, with north-west winds, following the withdrawal of the cyclonic cloud-disk; and it attains its greatest visibility between clouds, because much of the lower dusty air is then in shadow, and does not outshine the delicate colors of the ring. On some recent cloudless but slightly hazy days it has been entirely invisible.

I have not observed the connection between the visibility of the ring and the changes of temperature and formation of clouds noted by Professor Stone, and should be glad to learn more details as to date of observations, and as to closeness of the connection in point of time. A comparison of observations on these questions made at Colorado Springs (where I presume Professor Stone made his records) and on the summit of Pike's Peak would be very instructive in this respect.

The most remarkable point in connection with the ring is its persistence long after the cessation of the brilliant twilights with which it began. How is the volcanic dust or the ice dust that causes it supported so long? It seems incredible that dust could simply float for a year and a half in so thin a medium as the atmosphere at a height of ten or more miles. Electrical repulsion has been suggested as a supporting force, and it may be somewhat effective above the level of storm-circulation; but, besides this, it seems possible that the peculiar properties of water-vapor may give some aid. Wollaston long ago speculated on the limitation of the atmosphere at an altitude where its gases were frozen. The solid particles would there fall till evaporated, when the gases thus formed would rise again till frozen once more by the cold of expansion. Ritter and others have recently reconsidered this process. Whether the theory is applicable or not to oxygen and nitrogen, it certainly is of importance when water-vapor is considered: for, as is well known, the elasticity and condensibility of this constituent of the atmosphere are mutually antagonistic. The vapor tends to diffuse itself to altitudes where the cold caused by its expansion would require the condensation of a part of it; and, although such perfect diffusion is prevented in the lower atmosphere by the friction that the vapor suffers in passing through the air, it does not seem unreasonable to believe it may obtain at great altitudes where a normal distribution of vapor must be more nearly attained, and especially so at times when an extra supply of both vapor and dust is shot high out of volcanic craters. We may therefore believe that at some high level the atmosphere is 'saturated' with vapor: above this there will be continual condensation, supplying a delicate shower of the minutest ice particles; and, if these really need a solid nucleus to freeze upon, the nuclei may be sustained by the continuous upward diffusion of the vapor that rises to take the place of that which has been condensed, only to be condensed itself in its turn. Kiessling's discussion of the diffractive action of particles suspended at considerable altitudes fully accounts for the twilights and the solar ring; and the close agreement in date of occurrence of several great volcanic explosions, and subsequent brilliant twilight displays, naturally leads to the acceptance of the volcano as the source of the diffracting matter. Perhaps the Wollastonian idea may aid in explaining the remaining difficulty; namely, the long-continued suspension of some of the diffracting matter in the upper atmosphere.

W. M. DAVIS.

Cambridge, May 24.

Life.

In the brief abstract in *Science* (May 8, p. 386) of my address on 'Life,' at the celebration of the semi-centennial anniversary of the Lyceum of natural history of Williams college, I am credited with the following statement: "Kick a stone and a dog: the difference in the result *is caused* by education."

The words are printed in quotation-marks, as if they were my own; and, as a friend tells me that they seem to him to imply a belief that life has been produced by the education of dead matter, and that a stone might be educated into a dog, I hope you will give me space to say that the words are not mine.

Beyond the quotation, with approval, of Huxley's statement, — that "for us, at least, the distinction between living bodies, and those which do not live, is an ultimate fact," — the address contained no opinions regarding the origin or cause of life. It was devoted to the presentation of a definition; and I tried to show, first, that education makes us acquainted with the order of nature, and thus enables us to use one event as the sign of another which is to follow, and to regulate our actions according to the laws of nature; and secondly, that, since all living things respond to the order of nature in the same way, they also are educated; and that education, or the ability to make such responses, is life.

The writer of the abstract in *Science* had no opportunity to consult my manuscript, but I believe that the sentence which I have quoted is from his notes on a passage which reads as follows: "The actions of the dog are significant. They stand in relation to the external world, and their *meaning* could never be learned from the study of the dog's body, but must be sought in his environment, and that of his ancestors. The real difference between living and dead matter lies in this *significance* of the actions of living things. This is what we really mean when we say that the dog is alive, while the stone is not."

W. K. BROOKS.

EBENEZER EMMONS.

PROFESSOR EBENEZER EMMONS was born at Middlefield, Mass., May 16, 1800,[1] and died at his plantation, Brunswick county, N.C., on the 1st of October, 1863.

He was prepared for college at Plainfield, Mass., under the Rev. Mr. Halleck, entered Williams college at the age of sixteen, and was graduated in the class of 1820.

As a surgeon, Dr. Emmons ranked high in his profession, and for fifteen years was the most eminent practitioner in Berkshire county. He was appointed professor of chemistry at

[1] His birth has been variously stated as in 1798 and 1799; but he always stated to his children that he was born in 1800.

the Albany medical college in 1838, and was afterward transferred to the professorship of obstetrics, his connection with the college continuing until 1852.

Dr. Emmons's chief claim to remembrance lies in his work as a geologist. A favorite pupil of Professor Amos Eaton, he soon became interested in the mineralogy and geology of the western part of Massachusetts, and the adjacent region of the state of New York. Appointed professor of natural history at Williams college in 1833, he held that position till 1859, when he became professor of mineralogy and geology, an office which he held until his death in 1863.

His appointment as geologist of the second district of the geological survey of New York in July, 1836, gave the opportunity for the exercise of his power of acute observation in the field, which made his great reputation as a geologist. In 1837 Dr. Emmons first named, described, and classified the celebrated 'Potsdam sandstone.' In 1842 he pointed out a great system of stratified rocks under the Potsdam, which he called the 'Taconic system.' Two years later Dr. Emmons first described the primordial fauna, preceding the celebrated discoveries of Barrande, who recognized Emmons's right of priority in the following very courteous manner: "In comparing these dates, it is clear that Dr. Emmons was the first to announce the existence of a fauna anterior to that which had been established in the 'Silurian system' as characterizing the 'lower Silurian' division, and which I have named the second fauna. It is, then, just to recognize this priority, and I think it all the more fitting to state it at this time, that it has not hitherto been claimed." At a later date Emmons published further details, and described several other primordial fossils in his 'American geology' and 'Manual of geology' in 1855 and 1859.

The following familiar names, divisions, and classifications, of the paleozoic rocks of New York, are also due to Emmons: Chazy limestone, black marble of Isle la Motte, Lorrain shales, Champlain group, Ontario group, Helderberg series, and Erie group.

In 1851 Dr. Emmons was appointed state geologist of North Carolina. His discoveries in the coal-measures of Deep and Dan rivers, of a splendid triassic flora, with old vertebrates, such as fishes, saurians, and finally of the oldest mammal (Dromatherium sylvestre) yet found, not only in America, but in the whole world, are justly counted among the most important

contributions to the progress of American geology. Indeed, his description of the new red sandstone flora of North Carolina is so valuable, that the U. S. geological survey has recently reproduced the descriptions and all the plates given by Emmons in the sixth part of his 'American geology.'

Although educated in accordance with the Puritan discipline of the old New-England pattern, Professor Emmons was of a cheerful and most amiable disposition, and was respected and beloved by all who came in contact with him. I cannot better finish this too short notice of one of the greatest pioneers of American geology, than by quoting the opinion of one who was acquainted with him during his whole life, the respected and beloved Rev. Mark Hopkins, long president of Williams college, who says, "Emmons was a man of remarkable powers and great accuracy of observation. He seemed to have an intuitive perception of the differences in natural objects. He possessed an intense enthusiasm in his work, but in his manner was remarkably quiet. I have never seen the two things combined to the same extent. His perseverance knew no limit. It ought to be added, that, in connection with his science, he was deeply religious. Williams college is greatly indebted to him for its collections in natural history."

Jules Marcou.

THE ROYAL SOCIETY OF CANADA.

The fourth annual meeting of the Royal society of Canada took place last week in Ottawa. The proceedings extended over four days, beginning on Tuesday the 26th; and the attendance of members and delegates was, on the whole, very satisfactory, though not quite equal in number to that at the last meeting. Of fellows, about forty were registered, while thirteen affiliated societies were represented by delegates.

Tuesday was entirely devoted to the general meeting of the society, the morning being occupied by formal business and the reception of reports from delegates and committees; the afternoon, by the addresses of the president, Dr. T. Sterry Hunt, Vice-Presidents Dr. D. Wilson and Hon. P. J. Chauveau, and his excellency the marquis of Lansdowne as honorary president. Dr. Hunt, in the course of his address, took occasion to urge strongly the utility of the establishment of accurate tidal observations on the coasts of the Dominion, while the vice-president, in reviewing the work of the society, pointed out the special necessity of immediate effort in connection with ethnological research.

The society is divided into four sections, — two dealing with French and English literature, history, and allied subjects, respectively; one with mathematical, physical, and chemical sciences; and one with geological and biological subjects. Over thirty papers, in all, were presented; the meetings of sections going on simultaneously, and occupying the greater part of the time on Wednesday and Thursday. The papers of a purely literary or historical character scarcely fall within the province of this journal. The following notes embrace merely the salient points of some of the more important or novel scientific communications: —

In a paper on the mesozoic floras of a portion of the Rocky Mountain region north of the 49th parallel, Sir William Dawson referred specially to a remarkable Jurasso-cretaceous flora recently discovered, which occupies a stage much lower than the Dakota beds, and gives evidence of a great basin of lower cretaceous rocks in that part of the north-west. The paper was illustrated by a suite of specimens. A second paper by the same author related to certain new points in the geology of Prince Edward Island, and the correlation of the rocks of the island with the Permo-carboniferous, Permian, and triassic, as proposed by Mr. Bain. Mr. G. F. Matthew contributed a third part of his investigation of the Cambrian fauna of the vicinity of St. John, N.B., indicating the division of the Cambrian into several subordinate series, the relations of which, with their European and other equivalents, were discussed. In the Rev. Dr. Honeyman's essay on the geology of M'Nab's Island, Halifax, a point which gave rise to some discussion in the section was the described occurrence of glacially transported fragments of trap rocks like those of the Bay of Fundy. These must have been carried across the entire width of the peninsula of Nova Scotia. Prof. E. J. Chapman gave the results of a close examination of the Wallbridge hematite deposit in Ontario, which he considered as typical of a large class of ore-deposits in that region, and proved to be an irregular mass or 'stock-work' penetrat-